Remarks/Arguments:

Claim Status:

Claims 1-17 are pending in the present case. Claims 9-17 have been allowed and claims 1-8 stand rejected. The features of claim 5 have been included in amended claim 1. Claim 5 has been cancelled.

Claim Rejection under 35 U.S.C. § 102(b):

Claims 1-5, 7, and 8 have been rejected under 35 U.S.C. § 102(b) as being anticipated by Tsai et al. (US 6,308,667). Applicants respectfully traverse the rejection of these claims and respectfully submit that these claims are patentable over Tsai et al. for the reasons set forth below.

Independent claim 1 recites features that are neither disclosed nor suggested by Tsai et al., namely:

> parameters of the electromagnet and of the plate are such that at least part of the magnetic circuit formed by the electromagnet and the plate is in a state of ***magnetic saturation*** when the magnetic plate is in the proximity of the electromagnet ... the parameters of the electromagnet and of the plate and the shape of the plate being such that the magnetic circuit is in the state of ***magnetic nonsaturation*** when the plate is located at a distance from the electromagnet. [emphasis added]

Applicants disclose a magnetic circuit that is in a state of magnetic saturation when the plate is in proximity to the electromagnet so as to minimize the force of attraction exerted on the plate and therefore its velocity. Moreover, the magnetic circuit is in a state of non-saturation when the plate is remote from the electromagnet so as to maximize the force attraction exerted on the plate and therefore to minimize the switching time. The parameters and properties of the electromagnet and plate facilitate magnetic saturation of the magnetic circuit. As recited in paragraph 0024 of Applicants' specification:

> The parameters of the electromagnet and of the plate comprise, according to one embodiment, parameters related to the shape and/or the dimensions and/or the nature of the material (or the materials) forming the plate and the body of the electromagnet and/or the intensity of the current flowing through the coil of the electromagnet.

Tsai et al. disclose an electromechanical valve control actuator comprising two electromagnets driving a magnetic plate, the movement of which controls the displacement of the valve. The magnetic plate has one or more teeth extending outward, the teeth being received in corresponding sockets in the cores of the corresponding electromagnets. Tsai et al. teach that the linearity of force results from the geometry of the teeth 44 and the open faces 32 of the cores 28, 30 (see Column 4, Lines 38-42).

Tsai et al. fail to disclose saturation of the magnetic circuit when the plate is in proximity of the electromagnet and non-saturation of the magnetic circuit when the plate is located at a distance from the electromagnet. The marked difference between Applicants' invention and the cited art is readily apparent when comparing Tsai's Figure 3 with Applicants' Figure 4. Tsai et al. illustrate a linear force distribution over the air gap (see item 42, Figure 3), whereas Applicants illustrate a quasi-linear force distribution over the air gap (see item 41, Figure 4). This quasi-linear force distribution phenomena of Applicants' electromechanical valve is due to saturation and non-saturation of the magnetic circuit. As recited in paragraph 0017,

> thanks to this saturation, the force of attraction exerted by the electromagnet on the plate varies quasi-linearly when the value of the air gap approaches zero.

Furthermore, independent claim 1 recites another feature that is neither disclosed nor suggested by Tsai et al., namely:

> the magnetic plate having at least one contracted part spaced from the electromagnet when the plate is in the proximity of the electromagnet, wherein the contracted part is intended to be saturated when the plate is in the proximity of the electromagnet.

Support for the above recited features may be found, for example, in Figure 3A and Applicants' specification in paragraphs 0036 and 0038, respectively:

> [T]he plate comprises [contracted] parts 144 and 146 of a thickness h', which is appreciably smaller than the thickness h. Thus, the magnetic plate 114 has such a shape that it forms a contraction for the magnetic flux 150 generated by the electromagnet 108, such that this magnetic flux is concentrated in these contractions. As the magnetic flux 150 is conservative, the fact that the cross section of the plate 114 is reduced in some areas makes it possible to concentrate the magnetic induction in these [contracted] parts 144 and 146 having a thickness h'. Thus, the magnetic induction has a high value in the contracted parts, and it is therefore possible to obtain saturation of the material in these [contracted] parts 144 and 146.

> When the magnetic plate is close to an electromagnet, the magnetic flux 150 passes through the plate to a large extent, and the contracted parts 144 and 146 are saturated.

As best illustrated in Figure 7 of Tsai et al., the armature plate is in close proximity to the electromagnet core 30. In this arrangement, the exterior surfaces of the armature plate 34, i.e. the teeth 44 and the base 50 segments of the plate 34, are all in direct contact with the surfaces of the core 30. Moreover, Tsai et al. describe the abutment of the surfaces of the plate 34 with the surfaces of the core 30 in the specification. As recited in Column 4, Lines 54-65 of Tsai et al.:

> The ***height of the teeth 44 from base 50 to tip 52 substantially equals the separation between the base 50 and the opposing portion of the core 28*** or 30 when the armature plate 34 is in a neutral position biased by the springs 38 with no energizing either of the coils 24 and 26. Thus ***the tips 52 of the teeth 44 nearly engage their corresponding sockets 46*** prior to powering of either coil 24 or 26. Generally however, the height of the teeth 44 will be considerable and at least half the distance between the base 50 and the portion of the open faces 32, ***which it abuts***. [emphasis added]

Thus, it is submitted that Tsai et al. do not disclose at least one contracted part ***spaced from the electromagnet*** when the plate is in the proximity of the electromagnet, as recited in claim 1.

Accordingly, for the foregoing reasons, Applicants respectfully submit that claim 1 is patentable over Tsai et al. and should be allowed. Claims 2-4, 7, and 8 are dependent upon independent claim 1, and therefore should also be allowed at least as dependent upon an allowable base claim. Reconsideration of claims 1-4, 7, and 8 is respectfully requested.

Claim Rejections Under 35 U.S.C. § 103(a):

Claim 6 has been rejected under 35 U.S.C. 103(a) as being unpatentable over Tsai et al. (US 6,308,667) in view of Rookes et al. (US 5,992,821). Applicants respectfully traverse the rejection of this claim and respectfully submit that this claim is patentable over Tsai et al. and Rookes et al. for the reasons set forth below.

Applicants respectfully submit that Rookes et al. do not compensate for the deficiencies of Tsai et al., which deficiencies were set forth above in detail.

Rookes et al. disclose an electro-magnetically operated valve in which at least a portion of the armature member and/or the pole piece has in or on it a coating or layer of material having a higher mechanical hardness or a higher magnetic permeability than the material of the armature and/or pole piece.

Rookes et al. do not disclose a magnetic circuit that is in a state of magnetic saturation when the plate is in proximity to the electromagnet, and a state of non-saturation when the plate is remote from the electromagnet.

Moreover, as best illustrated in Figure 1 of Rookes et al., the planar surfaces of the coated pole piece 16, 18 are configured to be in direct contact with the planar surfaces of the coated armature member 14. Thus, Rookes et al. also do not disclose at least one contracted part ***spaced from the electromagnet*** when the plate is in the proximity of the electromagnet, as recited in claim 1.

Thus, because claim 6 includes limitations that are neither disclosed nor suggested by Tsai et al. or Rookes et al., alone or in combination, prima facie obviousness cannot be established even based on the hypothetical combination of the cited references as proposed in the Office Action. Reconsideration of claim 6 is respectfully requested.

Conclusion

In view of the amendments in the claims and the remarks set forth above, Applicants respectfully submit that this application is now in condition for allowance, which action is respectfully requested.

Respectfully submitted,

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April 19, 2006

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